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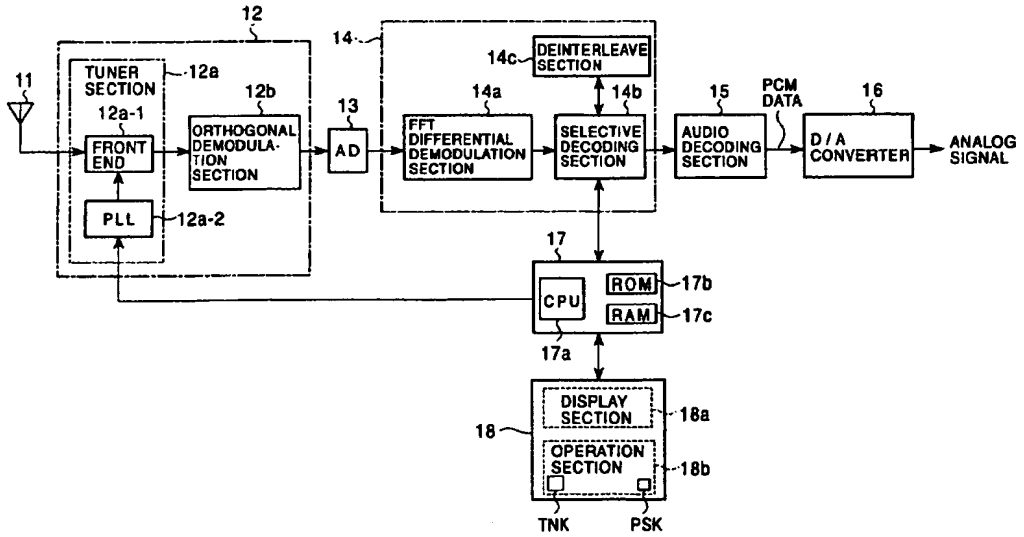
(54) Method of receiving programs, and use of this method in a DAB receiver

(57) When there is a plurality of programs of a set program type being broadcast, a user is allowed to recognize this plurality of programs and to be able to select the desired program. A control section (17) determines whether there is a plurality of programs of a program type specified by a user. When there is a plurality of programs, (1) the fact is displayed and the sound of the program of the set program type is selected and caused to be output by operating a program selection key PSK, or (2) the sound of the program of each set program type is output at fixed time intervals, and the sound of a program selected by operating the program selection key is continuously output, or (3) all the labels of the program of each set program type are displayed on a display section (18a) and the sound of a selected program is output.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method of receiving programs of a DAB receiver and, more particularly, to a method of receiving programs of a DAB receiver which receives the service (program) of a program type specified by a user.

2. Description of the Related Art

At present, the excellent characteristics of digital audio and the ease of use thereof are generally recognized and digital audio is rapidly becoming widespread. Against such a background, there has been an active trend towards digitization of audio broadcast, and digital audio broadcasting (hereinafter referred to as DAB) is now being realized in Europe.

Fig. 6 shows a DAB broadcasting signal (ensemble) frame structure of mode II adopted in the DAB system. One frame length is 24 ms, and the frame has a synchronization section SYNC of two symbols, a high-speed information channel section FIC (Fast Information Channel) of three symbols, and a data field section DFL of 72 symbols.

The synchronization section SYNC contains a null symbol used to recognize the start point of the frame and a phase reference symbol PRS. The high-speed information channel section FIC has high-speed information blocks FIB1 to FIB3 of three symbols and contains (1) time/date data, (2) an ensemble label (name which indicates the contents of a broadcasting signal in which a plurality of services (programs) are entered), (3) a service label (name which indicates the contents of individual service contents), (4) a service component label (name which indicates the contents (program name) in more detail than the service label), (5) array data of the service, (6) a program-type code PTY (genre) which indicates the program contents, and others.

The data field section DFL is divided into 72 data fields (symbols), and a broadcasting signal of a predetermined service (program) is inserted into each of the data fields so that broadcasting signals of six to eight services (programs) can be transmitted simultaneously from one broadcasting station. Which service (program) corresponds to which data field is specified by the array data of the service contained in the high-speed information channel section FIC.

Each of the high-speed information blocks FIB1 to FIB3 of the high-speed information channel section FIC has a hierarchical structure as shown in the figure, and predetermined data is inserted into a data field 103 specified by FIG type 101 and Extension 102.

That is, each high-speed information block FIB is made up of a FIB data field (30 bytes) and a CRC field (16 bits) of 256 bits, and the FIB data field contains a plurality of FIGs (Fast Information Groups). Each FIG (Fast Information Group) is made up of (1) a FIG type (the type of FIG) 101, (2) a length (the byte length of the FIB data field), and (3) a FIG data field. The FIG data field contains (1) Extension 102 (the identification number of type field) and (2) a data field 103. Various data, such as a service label or a program-type code PTY, are inserted into the data field 103.

For example, the service label information is inserted into the data field of FIG 1/1 (Type 1 field for extension 1) as shown in Fig. 7A, the program-type label information (to be described later) is inserted into the data field of FIG 1/2 (Type 1 field for extension 2) as shown in Fig. 7B, and the program-type information is inserted into the data field of FIG 0/17 (Type 0 field for extension 17) as shown in Fig. 8.

The data field specified by FIG 1/1 (Fig. 7A) has:

(1) a SId field which indicates the 16-bit service identifier which specifies a service,
(2) a character field which displays a service label (one word/8 bits) of 16 words, and
(3) a 16-bit character flag field which indicates the position of the used character when a service label of 16 words is abbreviated and represented by 8 words.

Also, the data field specified by FIG 0/17 (Fig. 8) has:

(1) a service identifier SId,
(2) an S/D (Static/Dynamic) flag which indicates whether or not a program-type code Int Code of (6) is a program-type code of the current program,
(3) reserved areas Rfa and Rfu,
(4) a number NCC of coarse codes,
(5) a number NFC of fine codes,
(6) a program-type code Int Code (international code is the same program-type code system as RDS (radio data system)) in accordance with the international code,
(7) a coarse code which indicates the coarse PTY code, and
(8) a fine code which indicates the fine PTY code.

The fine code specifies a genre finely, and the coarse code specifies a genre coarsely, each of which is selected by an international code or a national code. Receivers which do not correspond to the fine code use a coarse code.

Further, the data field specified by FIG 1/2 (Fig. 7B) has:

(1) a country flag which indicates whether or not the last two bytes (ECC country ID and RFa) are present,

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(2) a C/F flag which indicates which of the coarse code and the fine code is defined,

(3) a coarse code or a fine code,

(4) the language of the program-type label,

(5) a character field which defines a program-type label of 16 words,

(6) Chr-Flag which indicates whether or not the program-type label can be abbreviated and displayed, and

(7) an extension country flag (ECC: Extended Country Code).

Fig. 9 is a view illustrating the program-type code system in RDS, which shows the relationship between PTY codes and program contents (genre).

Although in the above description a frame structure of mode II for satellite broadcasts which use a 1.5-GHz band is shown, a frame structure of mode I in which a frequency band of 50 to 250 MHz is used has substantially the same structure, and one frame length is 96 ms.

Fig. 10 is a block diagram of a DAB transmitter. Reference numerals 1a to 1m denote a data compression section for performing low-rate coding of an analog audio signal into MPEG audio data. Reference numerals 2a to 2m denote a transmission-line coding section which adds an error detection and correction code. Reference numeral 3 denotes a multiplexing section which performs multiplexing on a time-division basis by mapping data output from each of the transmission-line coding sections 2a to 2m into a predetermined data field (symbol) in accordance with service array data. Reference numeral 4 denotes an interleave/OFDM (Orthogonal Frequency Division Multiplexing) modulation section which performs OFDM modulation by IDFT (Inverse Discrete Fourier Transform) and performs interleaving by rearranging the sequence of the multiplex signal within the symbol in accordance with a predetermined form. That is, the OFDM modulation section 4 divides each symbol (phase reference symbol, data symbol) into N sets by two bits, differentially codes first data of each set as a real-number part and second data as an imaginary-number part, and sequentially inputs the real-number part and the imaginary-number part of the differential code into the inverse Fourier transform section where it is IDFT-processed, thus outputting a modulated wave of the baseband.

Reference numeral 5 denotes an orthogonal modulation section which performs orthogonal modulation by converting the real-number part and the imaginary-number part output from the interleave/OFDM modulation section into an analog signal, multiplying each of them by a cos wave and a sine wave of a transmission local frequency fc, and synthesizing the multiplication results. Reference numeral 6 denotes a frequency conversion section which converts a transmission carrier wave obtained by orthogonal modulation into an RF signal. Reference numeral 7 denotes a transmission power amplifier 7.

Fig. 11 is a block diagram of a DAB receiver. Reference numeral 11 denotes an antenna. Reference numeral 12 denotes an RF-signal demodulation section for DAB, which multiplies a received signal by a cos wave and a sine wave of a carrier frequency fc and outputs a baseband analog signal. Reference numeral 13 denotes an A/D converter for converting a baseband analog signal into digital data at a predetermined sampling frequency. Reference numeral 14 denotes a transmission-line decoding circuit for decoding/outputting low-bit-rate coded data (MPEG audio data) by performing a FFT (Fast Fourier Transform) demodulation process, a differential decoding process, and the like, on digital data input from the A/D converter. Reference numeral 15 denotes an audio decoding section for decoding MPEG audio data into the original PCM (pulse code modulation) audio data. Reference numeral 16 denotes a D/A converter for converting PCM audio data into an analog audio signal. Reference numeral 17 denotes a controlling microcomputer for controlling the entire DAB receiver. Reference numeral 18 denotes an operation/display section. Reference numeral 18a denotes a display section. Reference numeral 18b denotes an operation section.

The transmission-line decoding circuit 14 comprises a FFT differential demodulation section 14a, a selective decoding section 14b, and a deinterleave section 14c. The FFT differential demodulation section 14a demodulates interleaved transmission data by performing a FFT process and a differential decoding process on digital data output from the A/D converter 13. The deinterleave section 14c deinterleaves the data output from the FFT differential demodulation section so as to return it to the original data array. The selective decoding section 14b performs an error detection and correction process on the deinterleaved data and inputs the contents of the high-speed information channel section FIC into the controlling microcomputer 17.

The controlling microcomputer 17 extracts a label contained in the high-speed information channel section FIC, which is input from the transmission-line decoding circuit 14, and inputs it to the operation/display section 18 so that it is displayed on the display section 18a. A user causes labels to be displayed in sequence by operating a program selection button on the operation section 18b, and when a desired label is displayed, the user operates the OK button so as to select the program. Thereupon, the controlling microcomputer 17 notifies the selective decoding section 14b of the symbol (data field) position of the selected program. The selective decoding section 14b outputs the decoded data (MPEG audio data) of the notified symbol to the audio decoding section 15. The audio decoding section 15 converts the input MPEG audio data into the original PCM audio data and outputs it. The controlling microcomputer 17 causes a service label and the like contained in the high-speed information channel section FIC to be displayed on the display section 18a of the operation/dis-

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play section 18 as required according to a request from the user.

Further, in the watch mode, when the PTY code which indicates the program type of a service (program) that the user wants to listen to is set by the operation section 18b, the controlling microcomputer 17 monitors whether the program of that program type is being broadcast or has begun by analyzing the high-speed information channel section FIC. If the program is being broadcast or has begun, the controlling microcomputer 17 performs control so that it is switched to the program automatically and sound is output.

In the watch mode, there is sometimes the occurrence of a plurality of programs having the same type as the program type PTY specified by the user being broadcast simultaneously or having begun. In such a case, a conventional program selection is made arbitrarily by the DAB receiver. For example, program sound of the user-specified program type which was found first is selected and output. However, in this case, the conventional DAB receiver does not notify the user that the same type of program is being broadcast in addition to the selected program. For this reason, in the case where, for example, the program type PTY of "sports" is set because of a desire to listen to a live broadcast of tennis, when a live tennis program and a live baseball program are simultaneously broadcast and the DAB receiver selects the baseball program, problems arise such as the live broadcast of the tennis program may not be listened to unless the user performs a specific operation, and the user may not even be aware that the live tennis program is being broadcast.

SUMMARY OF THE INVENTION

In view of the above, an object of the present invention is to make it possible for a user to recognize a plurality of programs when the plurality of services (programs) having the set program type have begun simultaneously or are being broadcast and to select a desired program from among these programs, and to output the sound of a program that the user actually wants to listen to.

To achieve the above-described object, according to one aspect of the present invention, there is provided a method of receiving programs of a DAB receiver which outputs sound of a program of a program type specified by a user, the method comprising the steps of: analyzing the contents of a high-speed information channel section contained in a DAB signal and determining whether a plurality of programs of a program type specified by the user are being broadcast; when a plurality of programs are being broadcast, displaying the fact and outputting the sound of one predetermined program; and selecting the program sound of another program type using a program selection key of an operation section and outputting it.

According to another aspect of the present invention, there is provided a method of receiving programs of a DAB receiver which outputs sound of a program of a program type specified by a user, the method comprising the steps of: analyzing the contents of a high-speed information channel section contained in a DAB signal and determining whether a plurality of programs of a program type specified by the user are being broadcast; when a plurality of programs are being broadcast, outputting the sound of each program at fixed time intervals; and continuously outputting the sound of the program selected using the program selection key of the operation section.

According to a further aspect of the present invention, there is provided a method of receiving programs of a DAB receiver which outputs sound of a program of a program type specified by a user, the method comprising the steps of: analyzing the contents of a high-speed information channel section contained in a DAB signal and determining whether a plurality of programs of a program type specified by the user are being broadcast; when a plurality of programs are being broadcast, determining the label of each program on the basis of the contents of a high-speed information channel section; and displaying the label of each program on the display section and outputting the sound of the program selected by referring to the displayed labels.

According to still a further aspect of the present invention, there is provided a DAB receiver, comprising: an antenna; an RF-signal demodulation section for DAB, which receives a desired DAB broadcasting signal wave and multiplies a received signal by a cos wave and a sine wave of a carrier frequency and outputs a baseband analog signal; an A/D converter for converting a baseband analog signal into digital data at a predetermined sampling frequency; a transmission-line decoding circuit for decoding/outputting low-bit-rate coded data by performing a FFT demodulation process, a differential decoding process, and the like; an audio decoding section for decoding the low-bit-rate coded data into the original PCM audio data; a D/A converter for converting PCM audio data into an analog audio signal; a control section for controlling the entire receiver on the basis of program array data contained in the high-speed information channel section and the program specified by a user or the program in accordance with the program type; and an operation/display section including a display section for displaying the label of the received program and other information, and an operation section having a program selection key and the like.

The above and further objects, aspects and novel features of the invention will become more apparent from the following detailed description when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a DAB receiver of the present invention.

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Figs. 2A, 2B, and 2C are schematic views illustrating program receiving control by setting a PTY code.

Fig. 3 is a process flow of first program receiving control.

Fig. 4 is a process flow of second program receiving control.

Fig. 5 is a process flow of third program receiving control.

Fig. 6 is a view illustrating the frame structure of a DAB broadcasting signal.

Figs. 7A and 7B are views illustrating a label.

Fig. 8 is a view illustrating program-type information.

Fig. 9 is a table showing the PTY codes corresponding to the program contents in RDS.

Fig. 10 is a block diagram of a DAB transmitter.

Fig. 11 is a block diagram of a DAB receiver.

DESCRIPTION OF THE PREFERRED EMBODIMENT

(a) The construction of a DAB receiver.

Fig. 1 is a block diagram of a DAB receiver of the present invention. Reference numeral 11 denotes an antenna. Reference numeral 12 denotes an RF-signal demodulation section for DAB, which receives a desired DAB broadcasting signal wave, multiplies the received signal by a cos wave and a sine wave of a carrier frequency fc, and outputs a baseband analog signal. Reference numeral 13 denotes an A/D converter which converts a baseband analog signal into digital data at a predetermined sampling frequency. Reference numeral 14 denotes a transmission-line decoding circuit for decoding/outputting low-bit-rate coded data (MPEG audio data) by performing a FFT demodulation process, a differential decoding process, and the like. Reference numeral 15 denotes an audio decoding section for decoding MPEG audio data into the original PCM audio data. Reference numeral 16 denotes a D/A converter for converting PCM audio data into an analog audio signal. Reference numeral 17 denotes a control section for controlling the entire receiver. Reference numeral 18 denotes an operation/display section which includes a display section 18a and an operation section 18b.

The RF-signal demodulation section 12 for DAB includes a tuner section 12a and an orthogonal demodulation section 12b. The tuner section 12a receives a DAB signal wave and converts it into an intermediate frequency signal, and is formed of a front end 12a-1 including a tuning section, a high-frequency amplifier, and a frequency converter, and a PLL (Phase Locked Loop) circuit (local oscillation circuit) 12a-2 which outputs a frequency signal in accordance with the selection-station frequency. The orthogonal demodulation section 12b multiplies the received signal by a cos wave and a sine wave of a carrier frequency fc and outputs a baseband analog signal.

The transmission-line decoding circuit 14 includes a FFT differential demodulation section 14a, a selective decoding section 14b, and a deinterleave section 14c. The control section 17, which is formed of a microcomputer, includes a CPU 17a, a program memory (ROM) 17b for storing various programs, and a data memory (RAM) 17c for storing data, and it is connected to the RF-signal demodulation section 12 for DAB, the transmission-line decoding circuit 14, and the operation/display section 18.

The FFT differential demodulation section 14a of the transmission-line decoding circuit 14 demodulates interleaved transmission data by performing a FFT process and a differential decoding process on digital data output from the A/D converter 13. The deinterleave section 14c deinterleaves the data output from the FFT differential demodulation section and returns it to the original data sequence, and the selective decoding section 14b performs an error detection and correction process on the deinterleaved data and inputs the contents of the high-speed information channel section FIC to the control section 17.

On the basis of the program array data contained in the high-speed information channel section FIC and the program specified by a user or the program in accordance with the program type PTY, the control section 17 determines the symbol position (data field) of the program and notifies the selective decoding section 14b. The selective decoding section 14b outputs the decoded data (MPEG audio data) of the notified symbol (data field) to the audio decoding section 15. The audio decoding section 15 converts the input MPEG audio data into the original PCM audio data and outputs it. Further, the control section 17 transmits the service label contained in the high-speed information channel section FIC to the operation section 18, and it is displayed.

The display section 18a of the operation section 18 displays the label of the received program and other information. The operation section 18b includes a ten-key pad TNK, a program selection key PSK, and other keys. The ten-key pad TNK is used to input a PTY code which specifies the program type and sets the program type to be received, and the program selection key PSK is used to select the desired program from among a plurality of programs of the set program type.

(b) Summary of program receiving control by setting PTY code.

Figs. 2A, 2B and 2C are schematic views illustrating program receiving control for setting a PTY code, which sets a program type, and for receiving a program in a watch mode.

(b-1) First program receiving control (see Fig. 2A)

The program type of a desired program (sports) to

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be received is input using, for example, a PTY code (see Fig. 9) of RDS by using the ten-key pad TNK. The control section 17 (Fig. 1) analyzes the contents of the high-speed information channel section of the DAB signal transmitted from the transmission-line decoding circuit 14 and determines whether there is a plurality of programs of the above-described set program type (sports) in the DAB signal. When there is a plurality of programs, the fact is displayed by a display lamp IND, and a predetermined PTY program (sports, specifically football) is selected, the sound of the program is output, and a program-type label (football) in accordance with the fine code of the program is displayed on the display section 18a. When a program-type label (fine code label) in accordance with the fine code is not present, a service label is displayed. The user recognizes that there is another program of a set program type because the display lamp IND is lit. Therefore, when the user wants to listen to a program other than football from among the sports programs, the user selects and causes the output of the sound of the other PTY program by operating the program selection key PSK.

(b-2) Second program receiving control (see Fig. 2B)

The program type of a desired program (sports) to be received is input using, for example, a PTY code of RDS by using the ten-key pad TNK. The control section 17 analyzes the contents of the high-speed information channel section of the DAB signal transmitted from the transmission-line decoding circuit 14 and determines whether there is a plurality of programs of the above-described set program type (sports) in the DAB signal. When there is a plurality of programs, the sound of the program of each set program type is output sequentially at fixed time intervals, and the fine code label of the program is displayed on the display section 18a. Then, the desired program is selected by operating the program selection key PSK.

(b-3) Third program receiving control (see Fig. 2C)

The program type of a desired program (sports) to be received is input using, for example, a PTY code of RDS by using the ten-key pad TNK. The control section 17 analyzes the contents of the high-speed information channel section of the DAB signal transmitted from the transmission-line decoding circuit 14 and determines whether there is a plurality of programs of the above-described set program type (sports) in the DAB signal. When a plurality of programs are present, the fine code labels of all the programs are displayed on the display section 18a, and the desired program is selected by the program selection key PSK by referring to the display.

(c) First program receiving control

Fig. 3 shows the process flow of first program receiving control.

When a DAB broadcast is to be received, the program type (for example, sports) of the desired program to be received is set using a PTY code (steps 101 and 102). Then, the control section 17 analyzes the contents of the high-speed information channel section of the DAB signal transmitted from the transmission-line decoding circuit 14 and determines whether there is a program of the set program type (sports) in the DAB signal (step 103).

If the program is not present, in other words, if the program of the set program type is not being broadcast, the process of step 101 and subsequent steps is repeated, while awaiting the broadcast of a program of the set program type.

When it is determined in step 103 that a program of the set program type is being broadcast, the control section 17 determines whether there is a plurality of programs of the set program type (sports) being broadcast (step 104). When there is only one program of the set program type being broadcast, the program is selected and the sound is output (step 105).

When, on the other hand, it is determined in step 104 that there are two or more programs of the set program type in the DAB signal, one program of a set program type (for example, football) is selected and the sound of the program is output, and the fine code label (football) of the program is displayed on the display section 18a (step 106). When the fine code label is not present, the service label is displayed.

Further, in addition to the above sound output, the display lamp IND (Fig. 2A) is lit indicating that there is a plurality of programs of the set program type (sports) (step 107). This allows the user to recognize that in addition to the program being currently listened to, another program of the set program type (sports) is being broadcast.

Then, it is determined whether the program selection key PSK has been operated (step 108). If the program selection key PSK has been operated, the other program of the set program type is selected and the sound of the other program is output (step 109). Therefore, when the user wants to listen to a program other than football from among the sports programs, the program selection key PSK is operated. Thereafter, the process returns to the start and the same process is repeated.

(d) Second program receiving control

Fig. 4 shows the process flow of second program receiving control.

When a DAB broadcast is to be received, the program type (for example, sports) of the desired program to be received is set using a PTY code (steps 201 and 202). Then, the control section 17 analyzes the contents of the high-speed information channel section of the DAB signal transmitted from the transmission-line

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decoding circuit 14 and determines whether there is a program of the set program type (sports) in the DAB signal (step 203).

If the program is not present, in other words, if a program of the set program type is not being broadcast, the process of step 201 and subsequent steps is repeated, while awaiting the broadcast of a program of the set program type.

When it is determined in step 203 that a program of the set program type is being broadcast, the control section 17 determines whether there is a plurality of programs of the set program type (sports) being broadcast (step 204). When only one program of the set program type is being broadcast, the program is selected and the sound is output (step 208).

When, on the other hand, it is determined in step 204 that there are two or more programs of the set program type in the DAB signal, the sound of the program of the set program type is sequentially output at fixed time intervals and the fine code label of the program is displayed on the display section 18a (step 205). This allows the user to recognize all the sports programs which are being broadcast. When the fine code label is not present, the service label is displayed.

Then, the control section 17 determines whether the program selection key PSK has been operated (step 206). If the program selection key PSK has been operated, control is performed so that the program sound of the set program type, which is being output at the time, is continuously output thereafter (step 207). Then, the process returns to the start and the same process is repeated.

(e) Third program receiving control

Fig. 5 shows the process flow of third program receiving control.

When a DAB broadcast is to be received, the program type (for example, sports) of a desired program to be received is set using a PTY code (steps 301 and 302). Then, the control section 17 analyzes the contents of the high-speed information channel section of the DAB signal transmitted from the transmission-line decoding circuit 14 and determines whether there is a program of the set program type (sports) in the DAB signal (step 303).

If the program is not present, in other words, if a program of the set program type is not being broadcast, the process of step 301 and subsequent steps is repeated, while awaiting the broadcast of a program of the set program type.

When it is determined in step 303 that a program of the set program type (sports) is being broadcast, the control section 17 determines whether there is a plurality of programs of the set program type being broadcast (step 304). When there is only one program of the set program type being broadcast, the program is selected and the sound is output (step 305).

When, on the other hand, it is determined in step 304 that there are two or more programs of the set program type (sports) in the DAB signal, the fine code labels of all of these programs are determined by analyzing the contents of the high-speed information channel section of the DAB signal and these are displayed on the display section 18a (step 306, Fig. 2C). This allows the user to recognize all the programs of the set program type (baseball, tennis, football) which are being broadcast.

Then, one program of a set program type (for example, baseball) is selected and the program sound is output, and the fine code label (baseball) of the program is inverted and displayed (step 307). Thereafter, the control section 17 determines whether the program selection key PSK has been operated (step 308). If the program selection key PSK has been operated, the control section 17 performs control so that the sound of the selected program is continuously output thereafter (step 309). Then, the process returns to the start and the same process is repeated.

(f) Modification

In the foregoing, a case has been described in which n number of programs contained in the DAB broadcasting signal (ensemble), which is being received, are targeted, and program receiving control is performed according to whether there is a plurality of programs of the set program type in the DAB broadcasting signal. However, it is also possible to extend the control to a DAB broadcasting signal other than that being received so as to perform the same control. A first method in such a case is one in which the reception of the DAB broadcasting signal currently being received is stopped at a cycle and at a time interval which will not exert any adverse influence on the quality of the output sound, another DAB broadcasting signal is received, and the contents of the high-speed information channel section are analyzed so that programs which are of the set program type and being broadcast are gathered.

A second method in such a case is one in which main and sub DAB receiving/demodulation sections 11 to 14 are provided, program sound is output on the basis of the output of the main and sub DAB receiving/demodulation sections, and all the DAB broadcasting signals are received sequentially by the sub DAB receiving/demodulation sections and the contents of the high-speed information channel section are analyzed so that programs which are of the set program type and being broadcast are gathered.

In the foregoing, the present invention has been described with reference to the embodiments; however, various modifications are possible within the spirit of the present invention described in the claims, and the present invention does not exclude such modifications.

As has been described up to this point, according to the present invention, the contents of the high-speed

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information channel section contained in the DAB signal are analyzed, it is determined whether there is a plurality of programs of the type specified by a user being broadcast, and if there is a plurality of programs of the type specified by the user being broadcast, the fact is displayed, and when the sound of one predetermined program is output, the sound of another program of the type specified by a key operation can be selected and output. Therefore, when there is a plurality of programs of the same type as the set program type being broadcast, it is possible for the user to recognize this plurality of programs and to select and listen to a desired program from among these programs.

Further, according to the present invention, the contents of the high-speed information channel section contained in the DAB signal are analyzed, it is determined whether there is a plurality of programs of the type specified by a user being broadcast, and when there is a plurality of programs of the type specified by the user being broadcast, the sound of each program is output at fixed time intervals, and the sound of the program selected by a key operation is continuously output. Therefore, when there is a plurality of programs of the same type as the set program type being broadcast, it is possible for the user to recognize this plurality of programs and to select and listen to a desired program from among these programs.

Furthermore, according to the present invention, the contents of the high-speed information channel section contained in the DAB signal are analyzed, it is determined whether there is a plurality of programs of the type specified by a user being broadcast, and when there is a plurality of programs of the type specified by the user being broadcast, the label of each program is determined on the basis of the contents of the high-speed information channel section, the label of each program is displayed on the display section, and the sound of the program selected by referring to the displayed labels is output. Therefore, when there is a plurality of programs of the same type as the set program type being broadcast, it is possible for the user to recognize this plurality of programs and to select and listen to a desired program from among these programs.

Claims

1. A method of receiving programs of a DAB receiver which outputs sound of a program of a program type specified by a user, said method comprising the steps of:

   analyzing the contents of a high-speed information channel section contained in a DAB signal and determining whether a plurality of programs of a program type specified by the user are being broadcast;
   when a plurality of programs are being broadcast, displaying the fact and outputting the sound of one predetermined program; and
   selecting the program sound of another program type using a program selection key of an operation section (18b) and outputting it.

2. A method of receiving programs of a DAB receiver according to claim 1, wherein when a fine code label of said one predetermined program is present, the fine code label is displayed on a display section (18a), and when the fine code label is not present, a service label is displayed on the display section (18a).

3. A method of receiving programs of a DAB receiver which outputs sound of a program of a program type specified by a user, said method comprising the steps of:

   analyzing the contents of a high-speed information channel section contained in a DAB signal and determining whether a plurality of programs of a program type specified by the user are being broadcast;
   when a plurality of programs are being broadcast, outputting the sound of each program at fixed time intervals; and
   continuously outputting the sound of the program selected using the program selection key of the operation section (18b).

4. A method of receiving programs of a DAB receiver according to claim 3, wherein a fine code label of each program is displayed on the display section (18a), and when the fine code label is not present, a service label is displayed on the display section (18a).

5. A method of receiving programs of a DAB receiver which outputs sound of a program of a program type specified by a user, said method comprising the steps of:

   analyzing the contents of a high-speed information channel section contained in a DAB signal and determining whether a plurality of programs of a program type specified by the user are being broadcast;
   when a plurality of programs are being broadcast, determining the label of each program on the basis of the contents of a high-speed information channel section; and
   displaying the label of each program on the display section (18a) and outputting the sound of the program selected by referring to the displayed labels.

6. A method of receiving programs of a DAB receiver according to claim 5, wherein the fine code labels of

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all the programs are displayed on the display section (18a), and when the fine code label is not present, a service label is displayed on the display section (18a).

7. A DAB receiver, comprising: an antenna (11); an RF-signal demodulation section (12) for DAB, which receives a desired DAB broadcasting signal wave and multiplies a received signal by a cos wave and a sine wave of a carrier frequency and outputs a baseband analog signal; an A/D converter (13) for converting a baseband analog signal into digital data at a predetermined sampling frequency; a transmission-line decoding circuit (14) for decoding/outputting low-bit-rate coded data by performing a FFT demodulation process, a differential decoding process, and the like; an audio decoding section (15) for decoding said low-bit-rate coded data into the original PCM audio data; a D/A converter (16) for converting PCM audio data into an analog audio signal; a control section (17) for controlling the entire receiver on the basis of program array data contained in the high-speed information channel section and the program specified by a user or the program in accordance with the program type; and an operation/display section (18) including a display section (18a) for displaying the label of the received program and other information, and an operation section (18b) having a program selection key and the like.

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FIG. 1

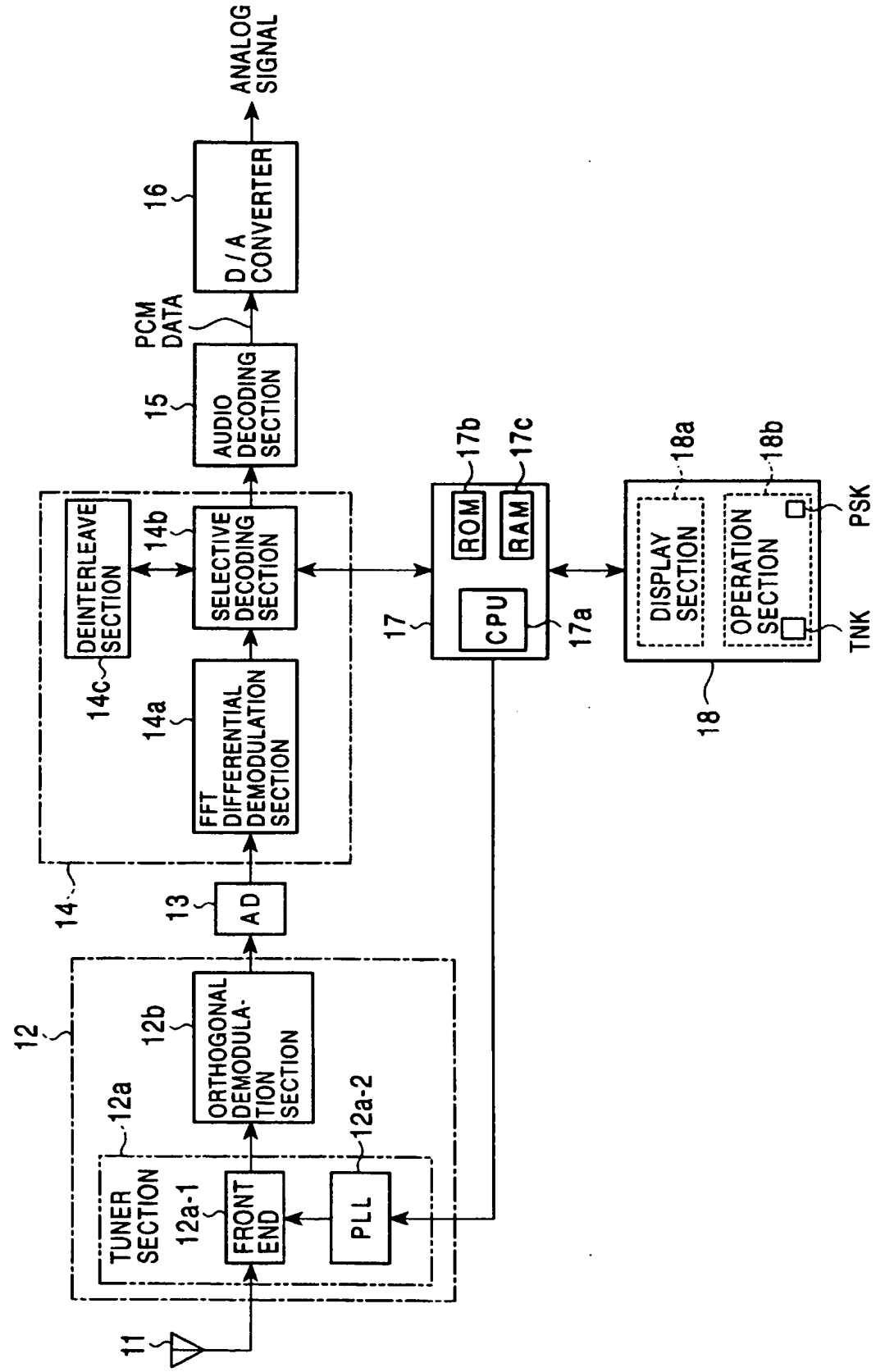

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FIG. 2A

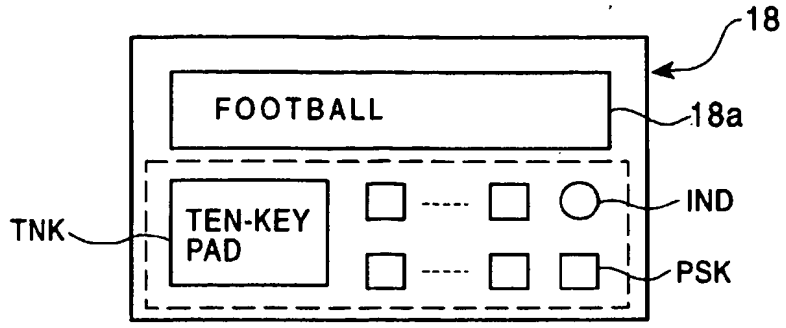

FIG. 2B

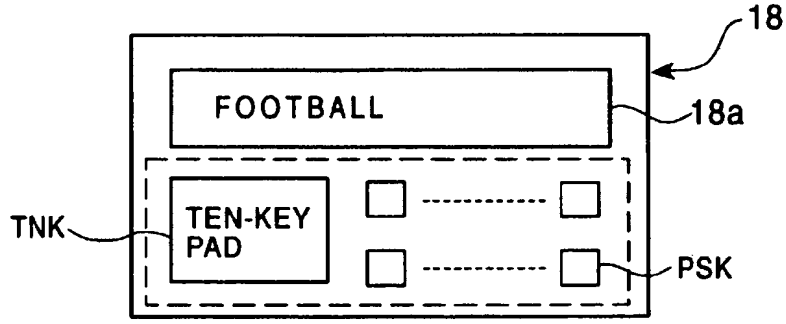

FIG. 2C

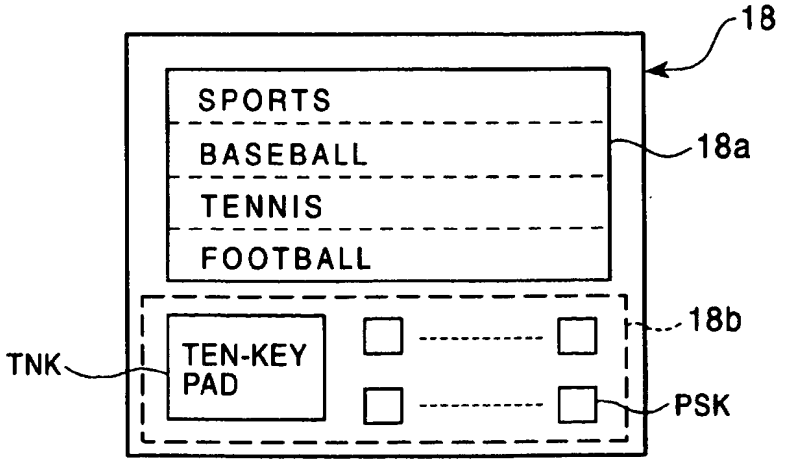

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FIG. 3

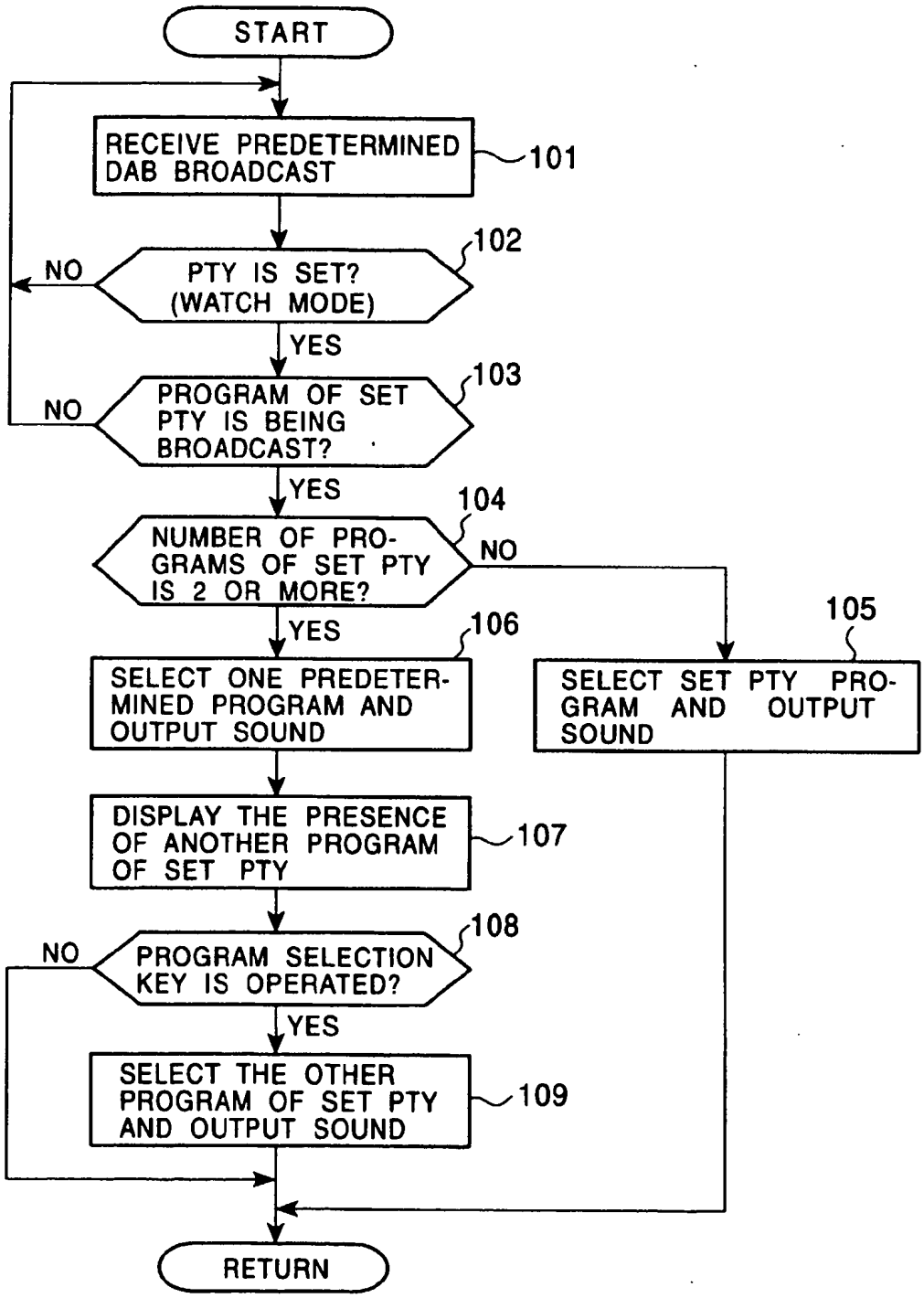

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FIG. 4

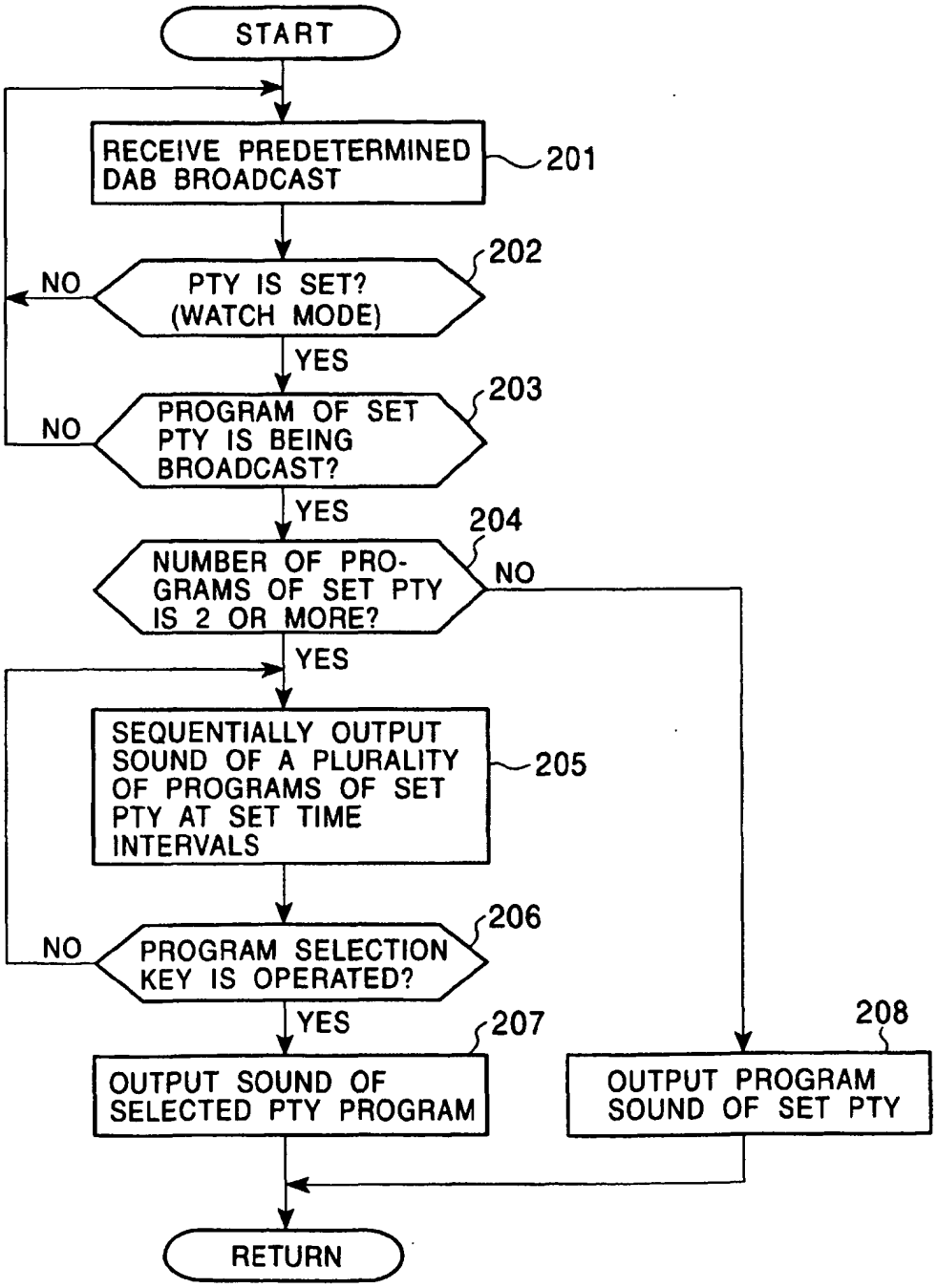

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FIG. 5

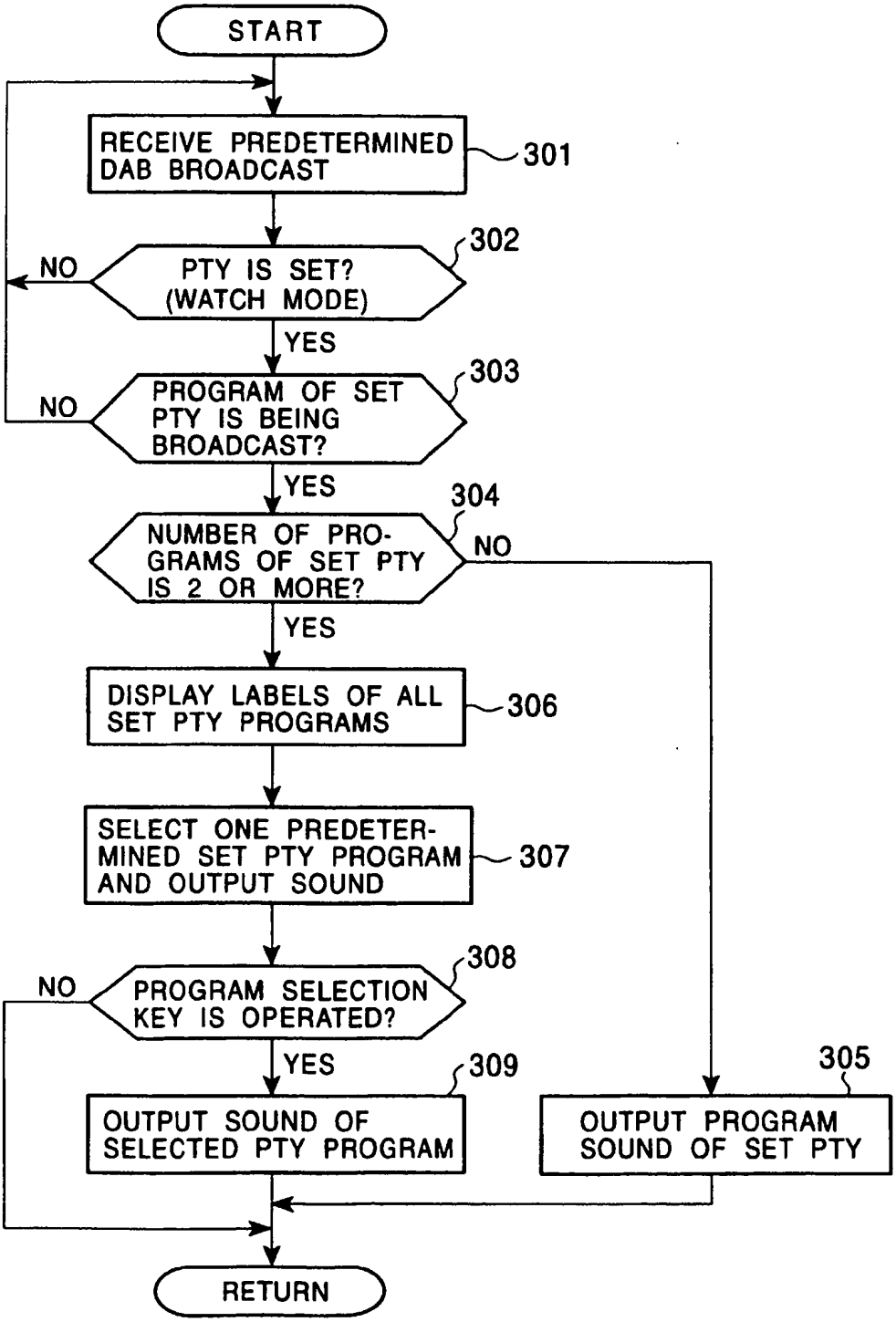

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FIG. 6

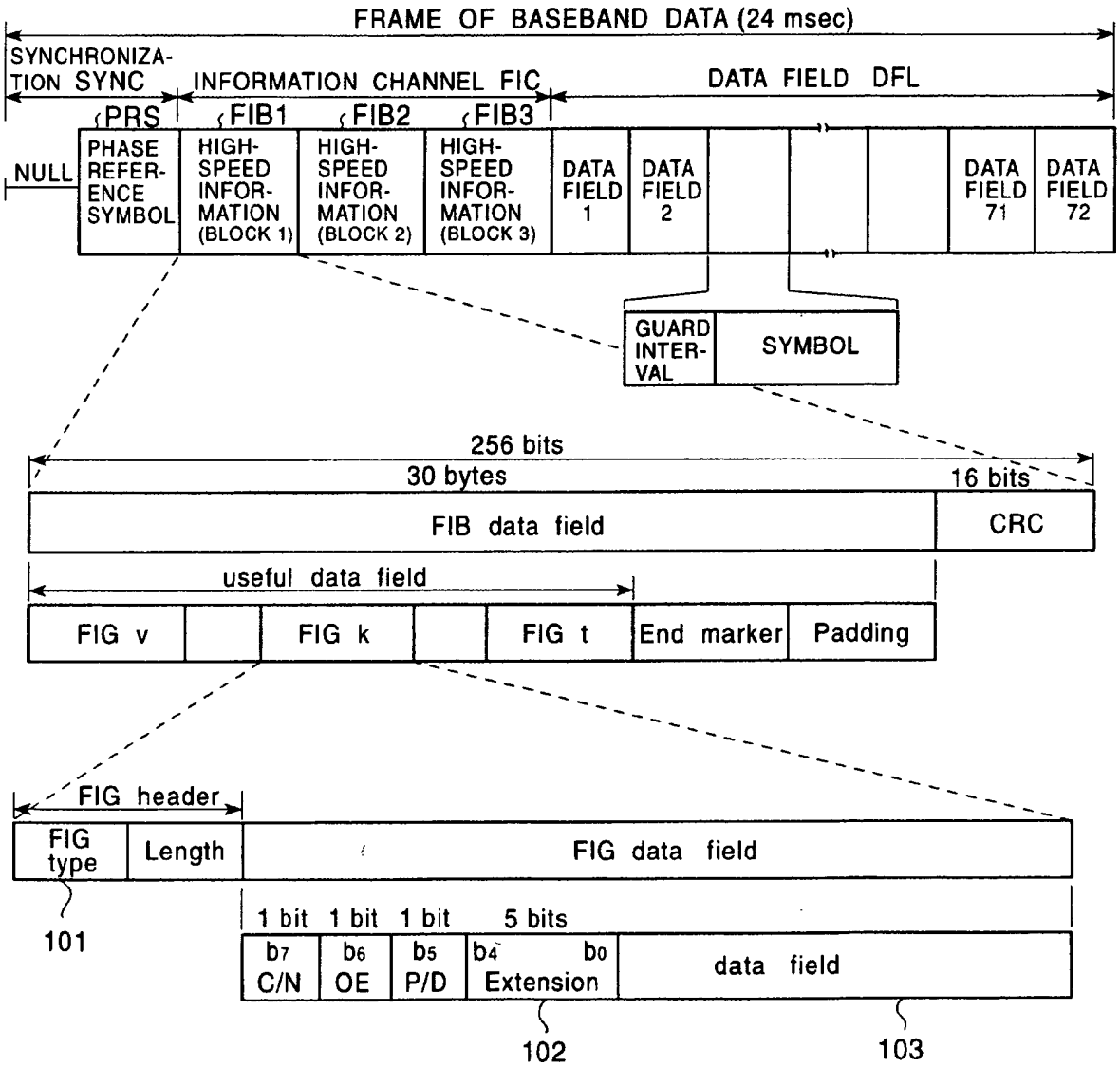

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FIG. 7A

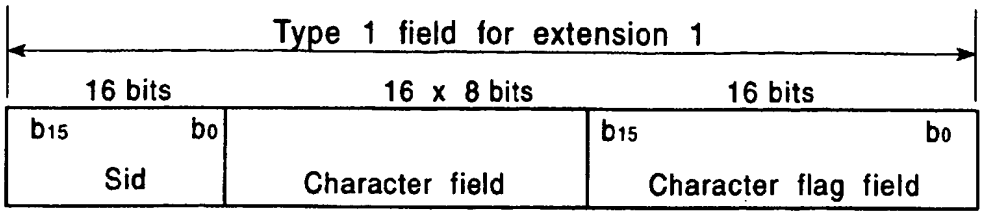

FIG. 7B

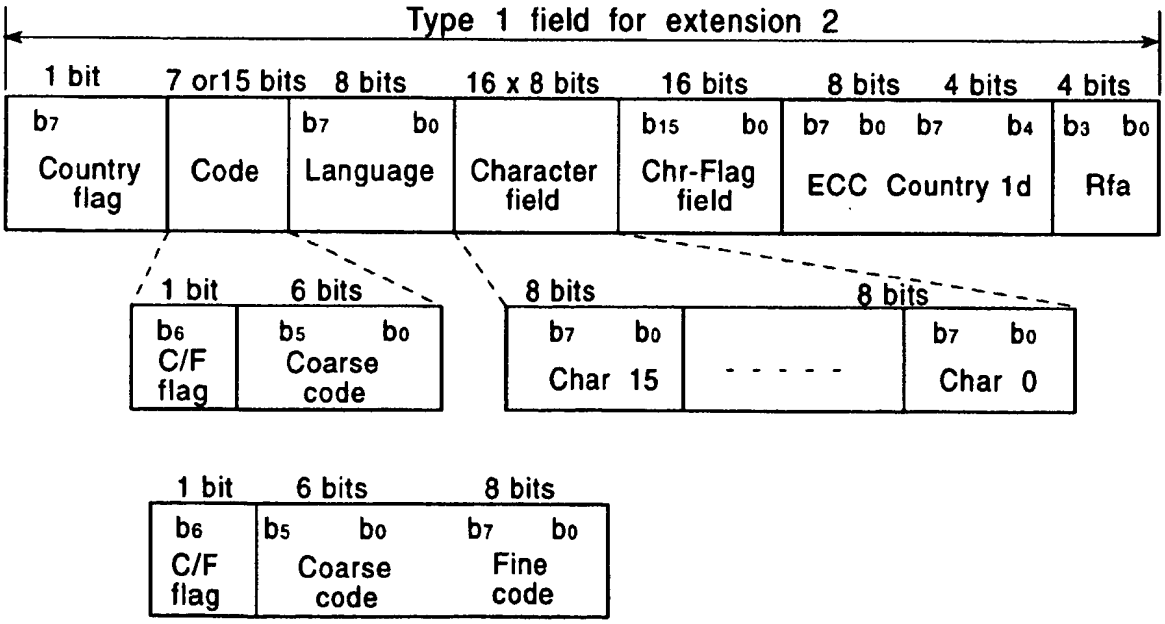

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FIG. 8

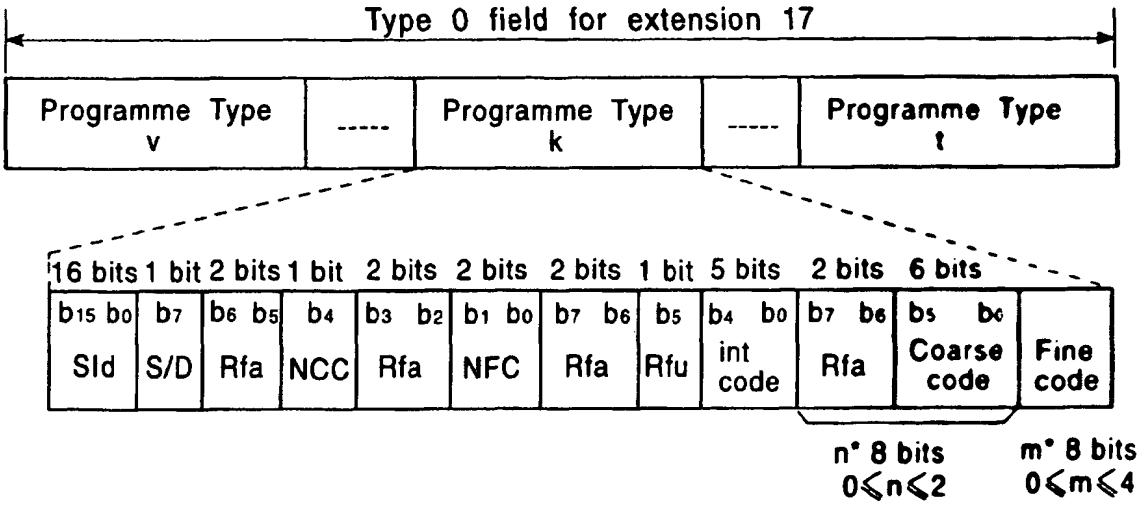

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FIG. 9

0 0 0 0 0	PROGRAM TYPE
0 0 0 0 1	NEWS
0 0 0 1 0	CURRENT TOPICS
0 0 0 1 1	MAGAZINE
0 0 1 0 0	SPORTS
0 0 1 0 1	EDUCATION
0 0 1 1 0	PROGRAMS FOR CHILDREN
0 0 1 1 1	PROGRAMS FOR YOUTH
0 1 0 0 0	RELIGION
0 1 0 0 1	DRAMA, LITERATURE, NOVEL
0 1 0 1 0	POP & FOLK MUSIC
0 1 0 1 1	LIGHT MUSIC
0 1 1 0 0	CLASSICAL MUSIC
0 1 1 0 1	JAZZ
0 1 1 1 0	FOLK MUSIC
0 1 1 1 1	VARIETY SHOWS

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FIG. 10

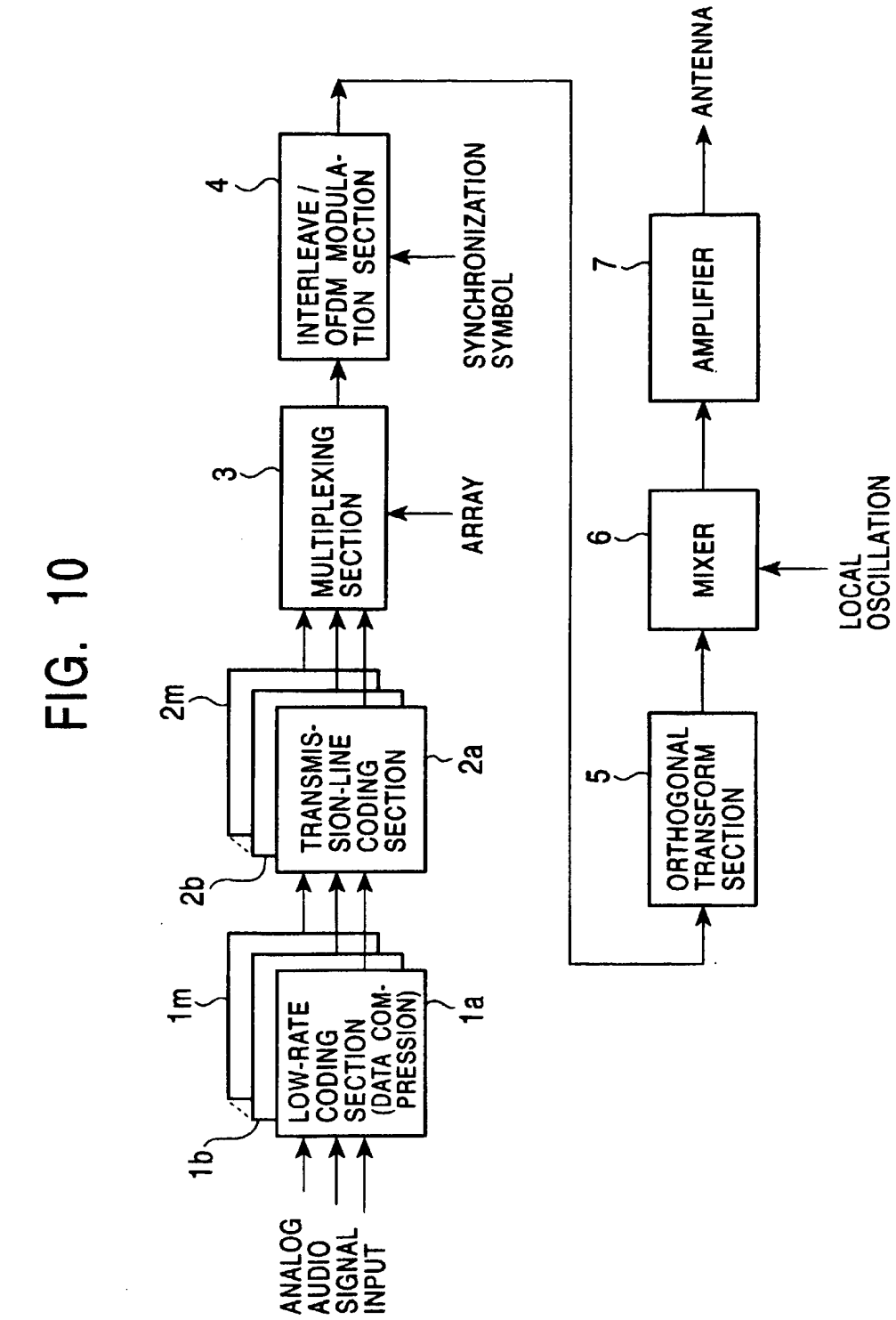

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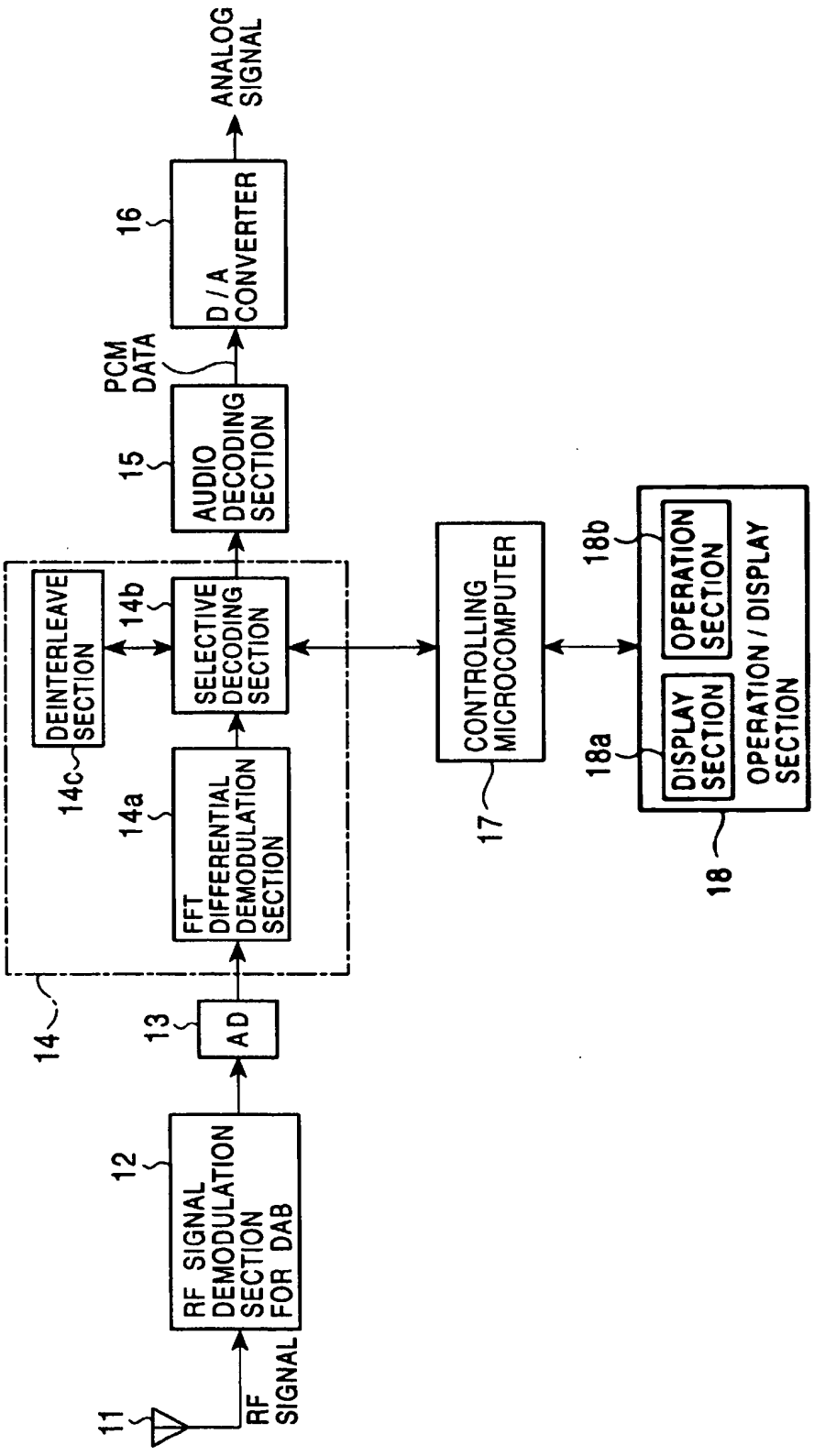
FIG. 11



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